WebEOC® in Daily Command Post Operations in an Integrated Information Environment at the USAF 45th Space Wing

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Abstract

WebEOC® was developed specifically for use in emergency operations centers. Modus Operandi, Inc. selected WebEOC® for a project with the US Air Force 45th Space Wing at Cape Canaveral Air Force Station and Patrick Air Force Base, Florida where it now serves as the basis for command post operations and crisis management activities on a daily basis. Deployed under the name "Shark Command and Control System" (SCCS), the system is based upon WebEOC and Modus Operandi's Wave® data integration product. This paper explores the customizations that were required to adapt WebEOC for the command post role, suggested approaches to managing incidents when using WebEOC on a daily basis, integration with other applications, and advanced use of Active Server Pages. Special emphasis is placed upon the integration of WebEOC into Modus Operandi's Wave product, which is serving as the Knowledge Management Framework (KMF) at the 45th Space Wing. The KMF federates data from a variety of structured (e.g. RDBMS) and unstructured (e.g. Word documents) sources into a semantic framework that supports queries, searches, and viewing of the data. Through the KMF, SCCS and other applications are able to access data stored in distributed, disparate data sources throughout the Space Wing. Finally, the use of this approach for emergency management at the state and regional levels is explored.

1 Introduction

The USAF 45th Space Wing is responsible for operating and maintaining the Eastern Range for launch operations. The Eastern Range includes Kennedy Space Center, Cape Canaveral Air Force Station (CCAFS), and Patrick Air Force Base (PAFB) as well as instrumentation sites at Antigua Island, Ascension Island, Argentia in Newfoundland, and Melbourne Beach, Florida. The 45th Space Wing uses a variety of Air Force and contractor resources to accomplish this mission. Due to the evolution of launch operations over many years with contributions from many different organizations and individuals there are a wide variety of data sources and little or no sharing of data among the data sources. Data has usually been shared through Word documents, PowerPoint presentations, and Excel spreadsheets. Collaboration among organizations and individuals has been via email, phone calls, documents on shared drives, or face-to-face meetings. Command operations, such as daily command post operations and battle staff crisis management, have been performed in the same ways. Figure 1 gives some idea of the scope of the data "silo" problem.

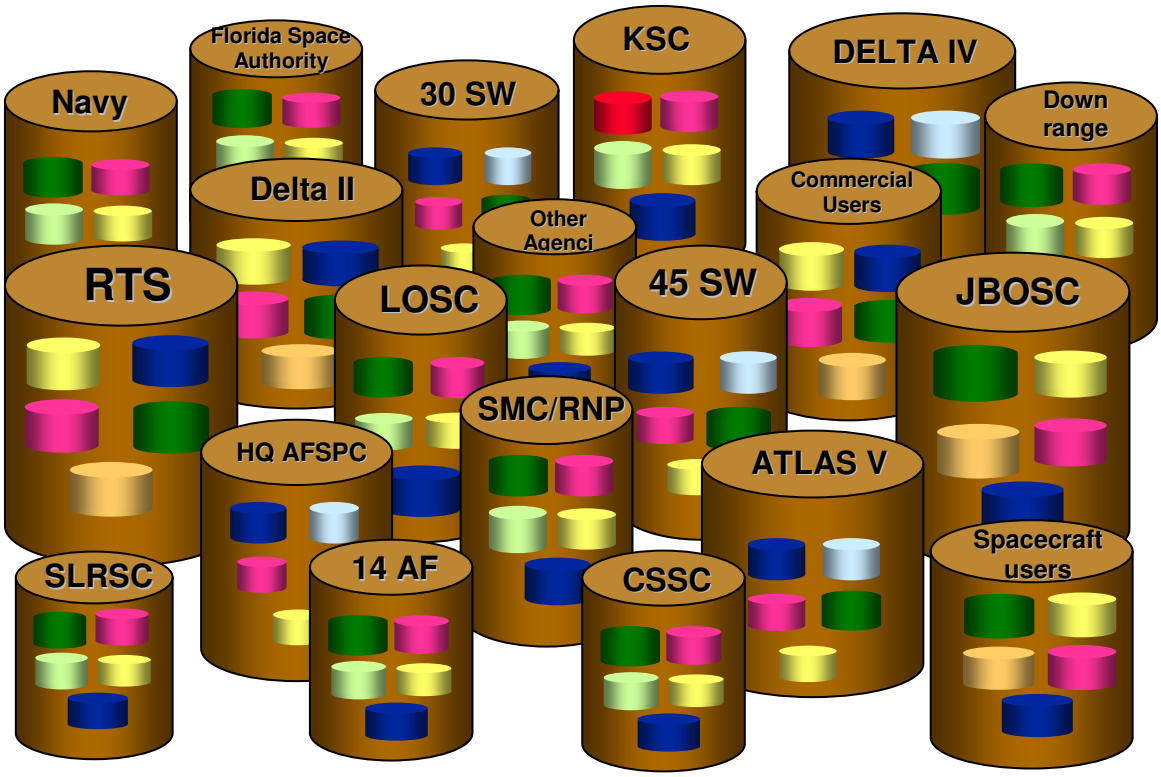

Figure 1: Many independent data "silos"

Several years ago, the Joint Base Operations Contractor (JBOSC), which is responsible for performing basic operations such as security at Kennedy Space Center and CCAFS, purchased WebEOC to serve as the software for its Emergency Operations Center (EOC). This has proven to be successful; however the system is only brought on-line when a hurricane condition is in effect. Moreover, despite the fact that logins were set up for people at adjacent PAFB, during hurricane operations the EOC has not been getting inputs from Patrick, so the 45th Space Wing command picture is fragmented in hurricane conditions.

The 45th Space Wing has undertaken an initiative to provide a Single Integrated Range Picture (SIRP) of the Eastern Range. The SIRP is intended to provide commanders, contractors, and other authorized personnel with a unified view of the data available in the many data source silos within the 45th Space Wing's area of responsibility. A key part of the SIRP initiative is an automated Wing Operations Center (WOC) combining both daily operational capabilities and crisis management capabilities allowing commanders to take full advantage of the integrated view of the data. The SIRP makes data such as launch schedules, hazardous operations schedules, resource usage, and range instrumentation status readily available to end-users and applications without those clients having to be aware of all the underlying data sources. At the same time, it allows the continued use of legacy systems and data sources without modification.

2 The Knowledge Management Framework

Major elements of the SIRP initiative have been implemented by Modus Operandi, Inc. with funding made available through the Small Business Innovation and Research (SBIR) program. This includes the 45th Space Wing Knowledge Management Framework (KMF). The KMF provides a common access point into the 45th Space Wing "data cloud" for users and applications. Figure 2 illustrates the role of the KMF as part of the SIRP.

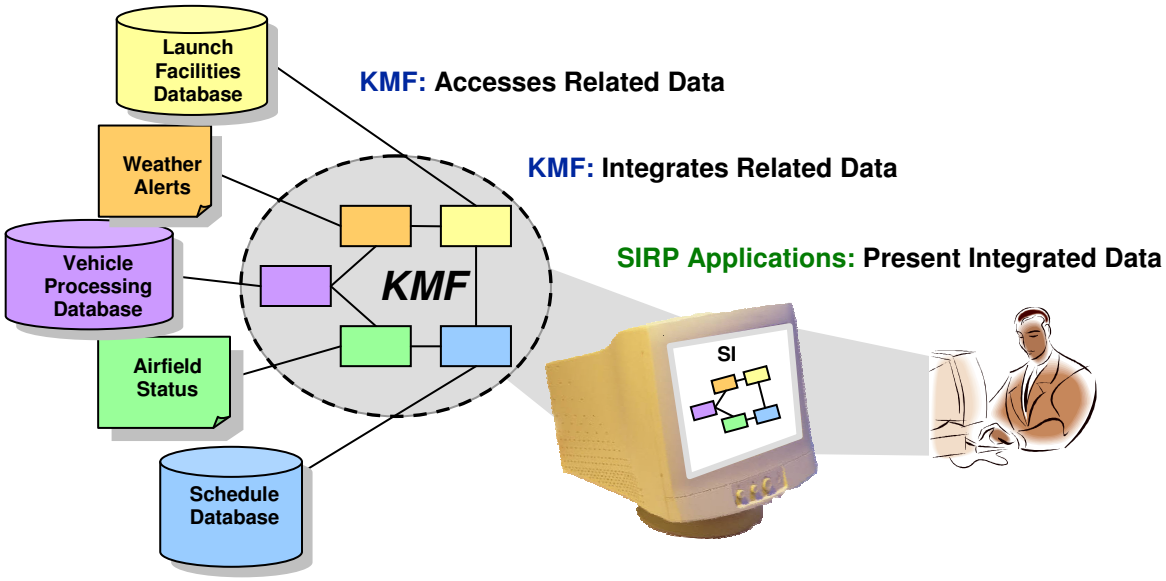

Figure 2: Provide an Integrated Picture of Data through the KMF

The KMF is based upon Modus Operandi's Wave product, which leverages BEA's AquaLogic Data Services Platform™ and WebLogic Application Server™. Figure 3 shows an architectural view of the KMF.

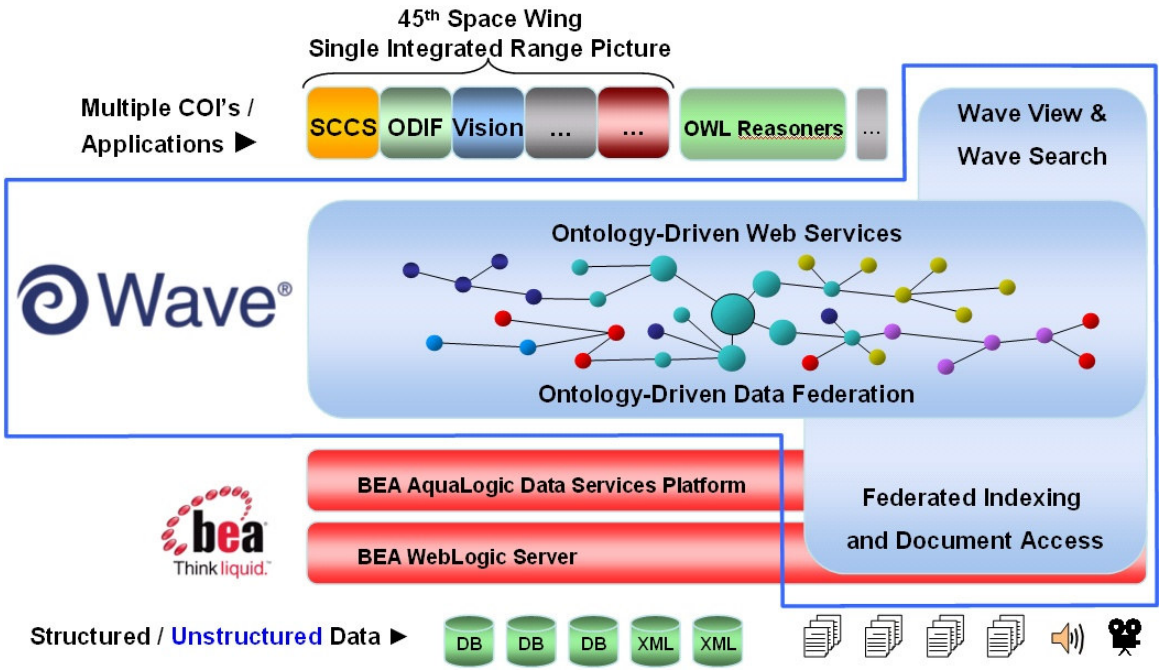

Figure 3: KMF/Wave Architecture

The KMF provides ontology-driven semantic information integration. A domain model is constructed in Web Ontology Language (OWL) format. OWL allows the user to specify both concepts and relationships between concepts as well as various restrictions and constraints on the relationships. This model serves as a "logical" model to which physical data sources are then mapped using BEA's AquaLogic Data Services Platform™. In effect, the logical data model is populated with instance data based on the mappings to physical data source fields. Relationships are also mapped so that instance data can be traversed using the relationships. For example, if the model contains the concepts of Person, Building, and Certification and the relationships "Building is-Workplace-Of Person" and "Person has Certification", the following query could be formulated:

1. Select all Persons for which the statement "Building 4052 is-Workplace-Of Person" is true.
2. Of the Persons returned, select those for which the statement "Person has Certification" is true and Certification attribute "type" equals "CPR".

This would return all the people working in Building 4052 who have been certified in CPR. This answer would be returned by a single query against the KMF even if the information regarding who works in what building were stored in a database and the certification information for each person were stored separately in an XML document. The KMF is rendered yet more powerful by providing the capability to map multiple independent data sources to fields in the same logical concept class and the capability to perform transformations on data in legacy data systems into a common format embodied in the logical model. Figure 4 illustrates these capabilities.

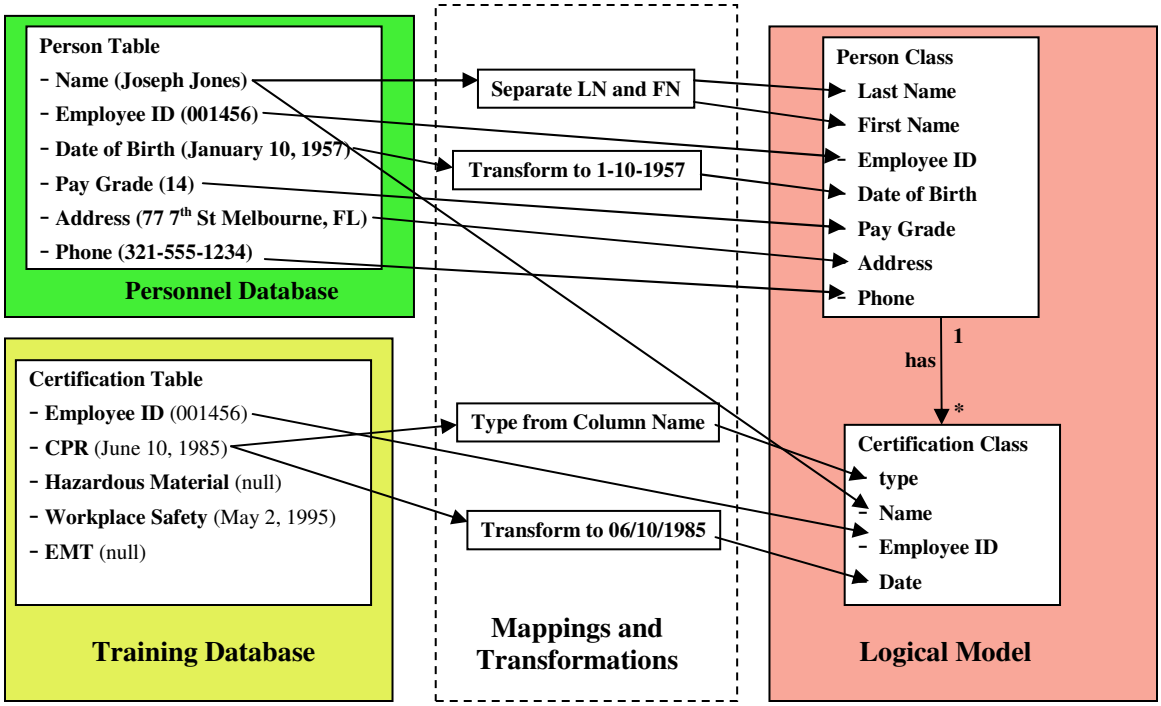

Figure 4: Mappings and Transformations

Additionally, Wave provides keyword search capabilities similar to Google™ by crawling and indexing all structured (e.g. RDMS, XML) and unstructured data (e.g. documents, RDBMS character fields) mapped to the deployed Logical Model. Wave Search presents results as a seamless blend of hits found within structured and unstructured data sources. Wave also supports visualization and browsing of the deployed Logical Model and instance data that falls within each concept. Using Wave View, the user can follow relationships among the instances and "walk" the entire data cloud. Figure 5 illustrates both Wave View and Wave Search.

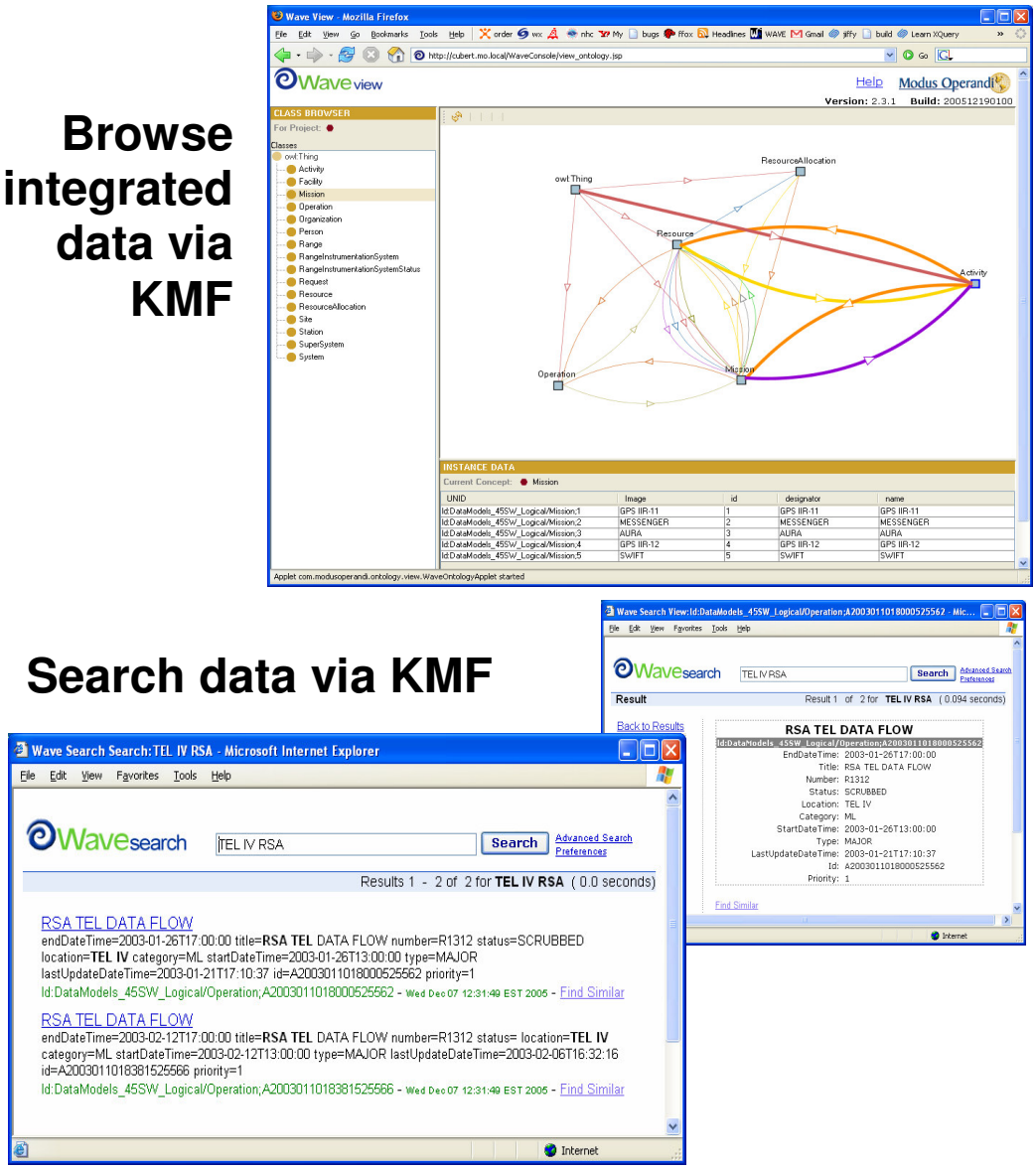

Figure 5: Wave View and Wave Search Capabilities

3 SCCS and WebEOC

In addition to our role of deploying Wave as the 45th Space Wing KMF, Modus Operandi was tasked with developing the Shark Command and Control System (SCCS). As shown in Figure 3, SCCS is one of the applications extracting data from the KMF to present a unified picture of range operations for commanders on a daily basis and also during crisis management situations. The requirements for SCCS specifically called for event log and checklist capabilities as well as the ability to view geo-spatial data. Given these requirements, a "build vs. buy" assessment was conducted early in the SCCS project. After seeing a demonstration of the WebEOC installation at the JBOSC EOC, it became

apparent that WebEOC might be able to provide these capabilities as well as much more. Further investigation confirmed this and demonstrated that WebEOC could provide "out-of-the-box" capabilities and an extensible framework for SCCS. Leverage of WebEOC would facilitate the development and deployment of a fully operational command post in much less time than would be the case if an attempt was made to develop the same capabilities from "scratch".

WebEOC was purchased and installed at Cape Canaveral Air Force Station in late October of 2005. By December 1, the Patrick Air Force Base command post began parallel operations in which they used the SCCS capabilities but also continued to maintain their paper-based processes. After completion of user training, delivery of additional documentation, and the development of additional boards and capabilities, the command post was deemed ready for operation in February of 2006. The following sections explain the procedures and customizations that were performed to make WebEOC satisfy the 45th Space Wing command post requirements.

3.1 Incident Management

One of the first procedures that needed to be established was how to handle daily operations in the context of incidents. Since WebEOC operations are centered around one or more incidents, it was apparent that an incident had to be created and maintained to serve as the context for daily operations. The main question to be answered was *how long* such an incident should be maintained. One could create a new incident for daily operations every day or on a weekly, monthly, or even yearly basis. After weighing various pros and cons, it was decided that conducting daily operations on a monthly basis was the best option. At the beginning of each month an incident is created. The incident is named according to the month, for example, "Daily Operations – 12-2005". At the end of the month the incident is archived and a new incident is created. This allows monthly operations to be archived and turned into simulations that provide sufficient data for extensive training, but not the overwhelming volume of data that a year-long incident would generate.

The 45th Space Wing has a set of three standard threat conditions used for crisis management. These conditions are Force Protection Condition, Information Condition, and Hurricane Condition. In addition to these, an incident such as an aircraft accident, a bomb threat, or a major non-aircraft related accident could escalate to a crisis level. During a crisis the commander's Battle Staff is activated and the crisis is managed from a battle staff area. When any condition arises that requires activation of the Battle Staff, a new incident is created to manage the crisis. There could be multiple crises to manage simultaneously. For example, in 2004 recovery efforts from Hurricane Francis were still underway when preparations for Hurricane Jeanne were in progress.

The command post and Battle Staff can communicate with each other through email, chat rooms, phone, and event logs. When desired, Battle Staff events can be directed to the command post event log as well as the Battle Staff event log. In addition, certain users

are authorized to log in to a master view that allows them to see data from all current incidents rolled up into the master view. In this manner commanders can track both crisis incidents and the daily command post operations. Note that all these capabilities come "out-of-the-box" with WebEOC.

3.2 Modifications to WebEOC

A number of modifications were made to WebEOC to satisfy 45th Space Wing requirements. The following sections explain the changes that were made.

3.2.1 Checklists

Several changes were made to the checklist capability provided in WebEOC. The checklists for the 45th Space Wing are derived from Operations Plans. Some changes were made to create a connection between the Operations Plans and the checklists. Others were made for the convenience of the users. The changes made to checklists were:

1. The addition of a description area to allow the users to enter a description of what the checklist is used for and when it should be used. This usually corresponds to guidance provided in the corresponding operations plan.
2. The addition of a field to enter a URL for the checklist. In most cases the URL would be a link to the corresponding operations plan.
3. A "Clear Checklist" option was added to clear all the checklist entries. This was found to be necessary for daily operations since the same checklist might be used multiple times in the course of a one month daily "incident". Without the "Clear Checklist" option the user was forced to manually uncheck each entry.
4. A URL field was added for each step of the checklist to allow the step to be linked to a document or a particular section of a document.
5. A field was added to display classification information. Military organizations require that all documents and displays carry classification information such as "Unclassified", "Secret", etc.
6. A field was added to display the last revision date for the checklist. Since each checklist must be kept in synch with its corresponding Operations Plan, this provides a means for users to verify that the contents of the checklist are current.
7. A new option was added for showing that a checklist step is completed. This option is a Simulation option for training purposes.
8. To improve legibility for personnel in the Battle Staff area, the size of the font was increased relative to plasma screen resolution.

Figure 6 shows the initial administrative (admin) screen for creating a checklist.

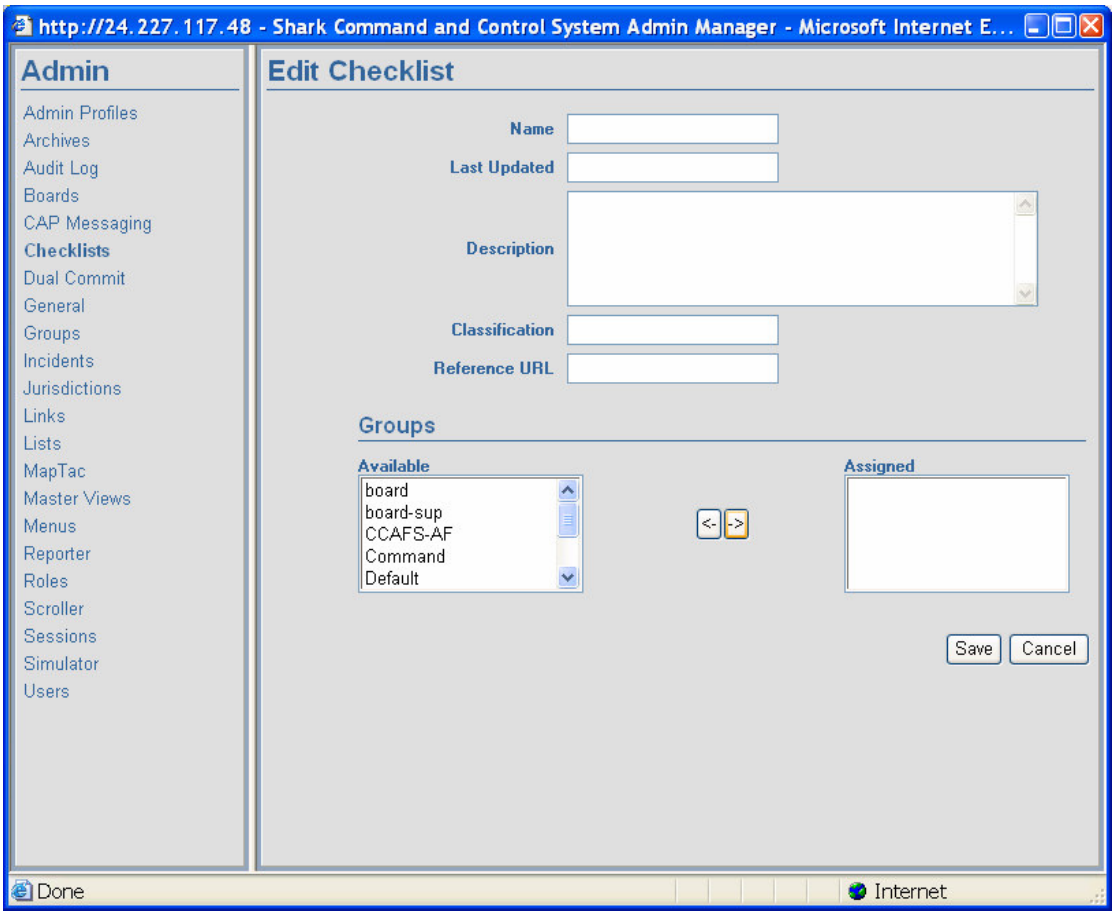

Figure 6: Create Checklist Admin Screen

Figure 7 shows the edit checklist admin screen, again with additional fields.

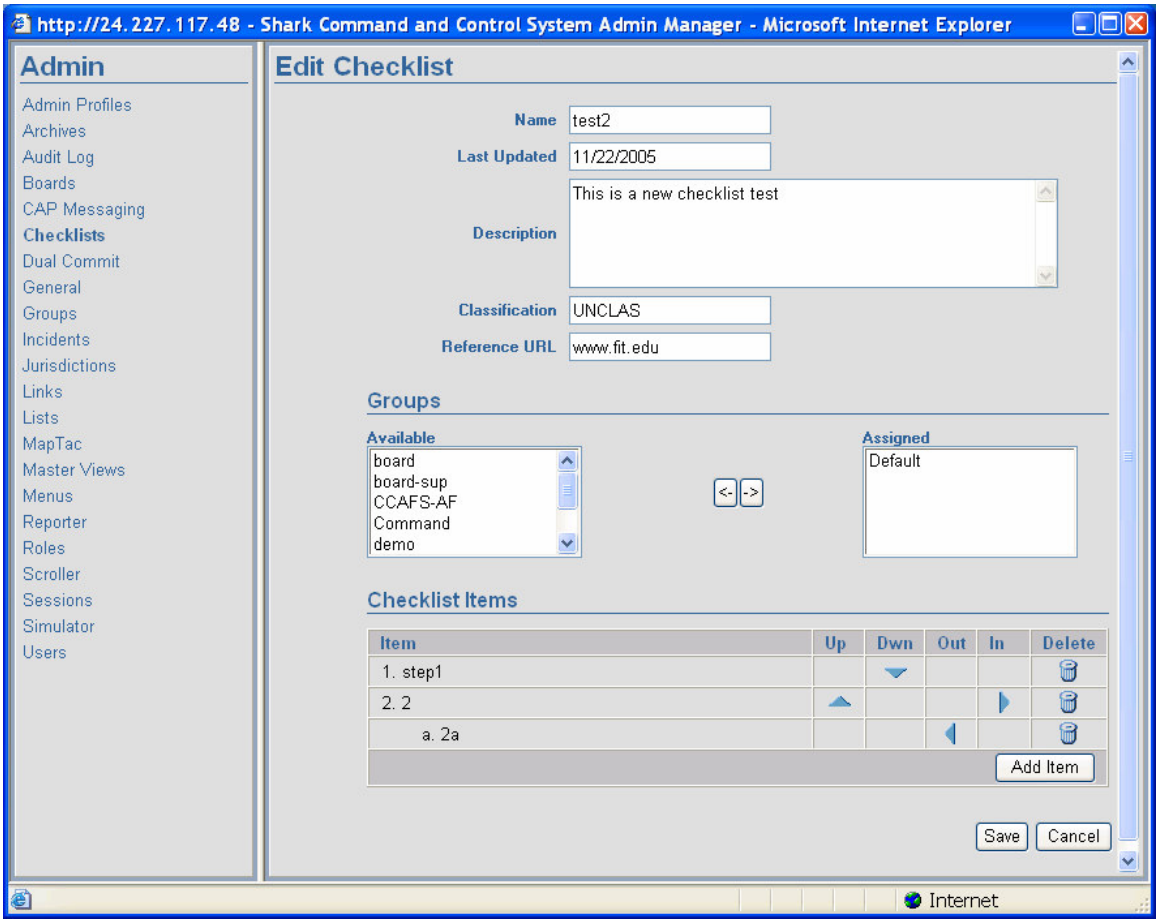

Figure 7: Edit Checklist Admin Screen

Note the added Description, Classification, Last Updated, and URL fields.

Figure 8 shows the “add item” screen with the new URL field.

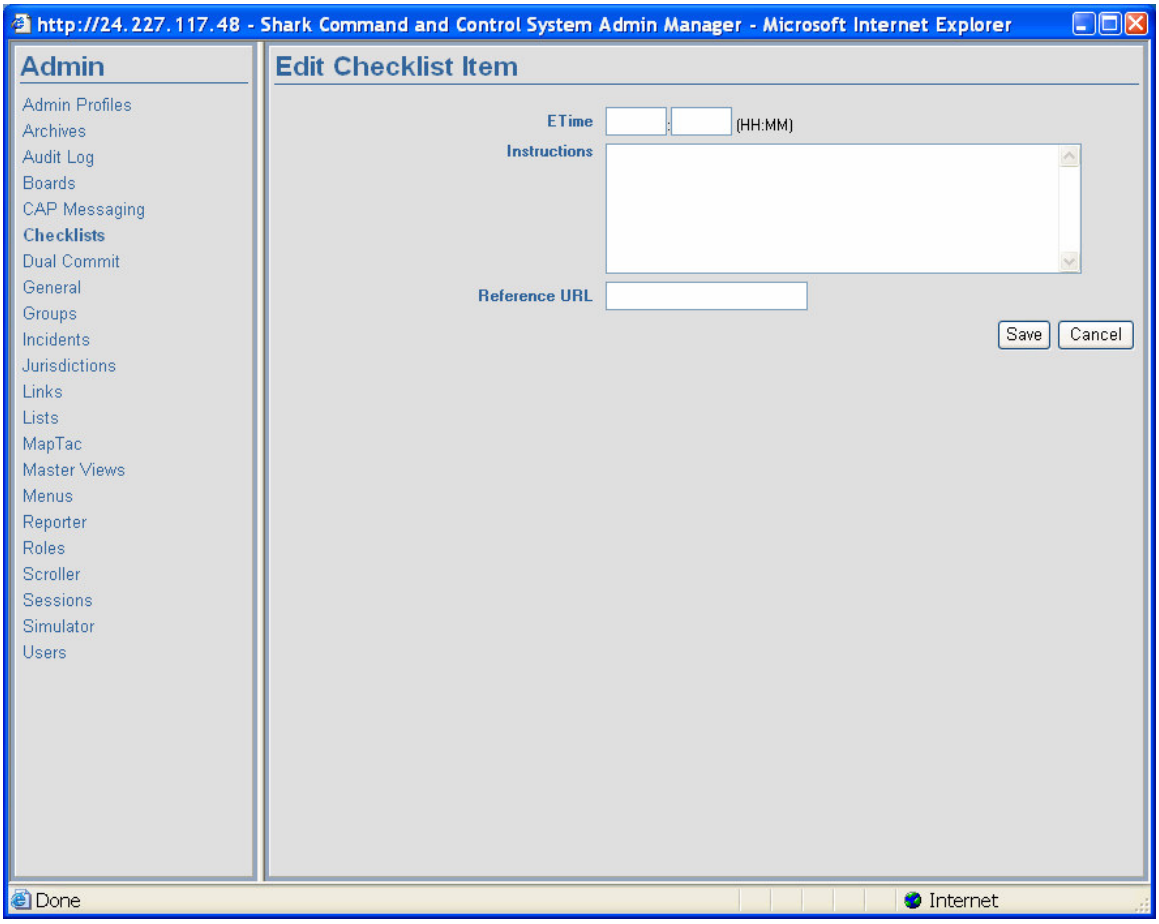

Figure 8: Add Item Admin Screen

Figure 9 shows an example checklist being displayed.

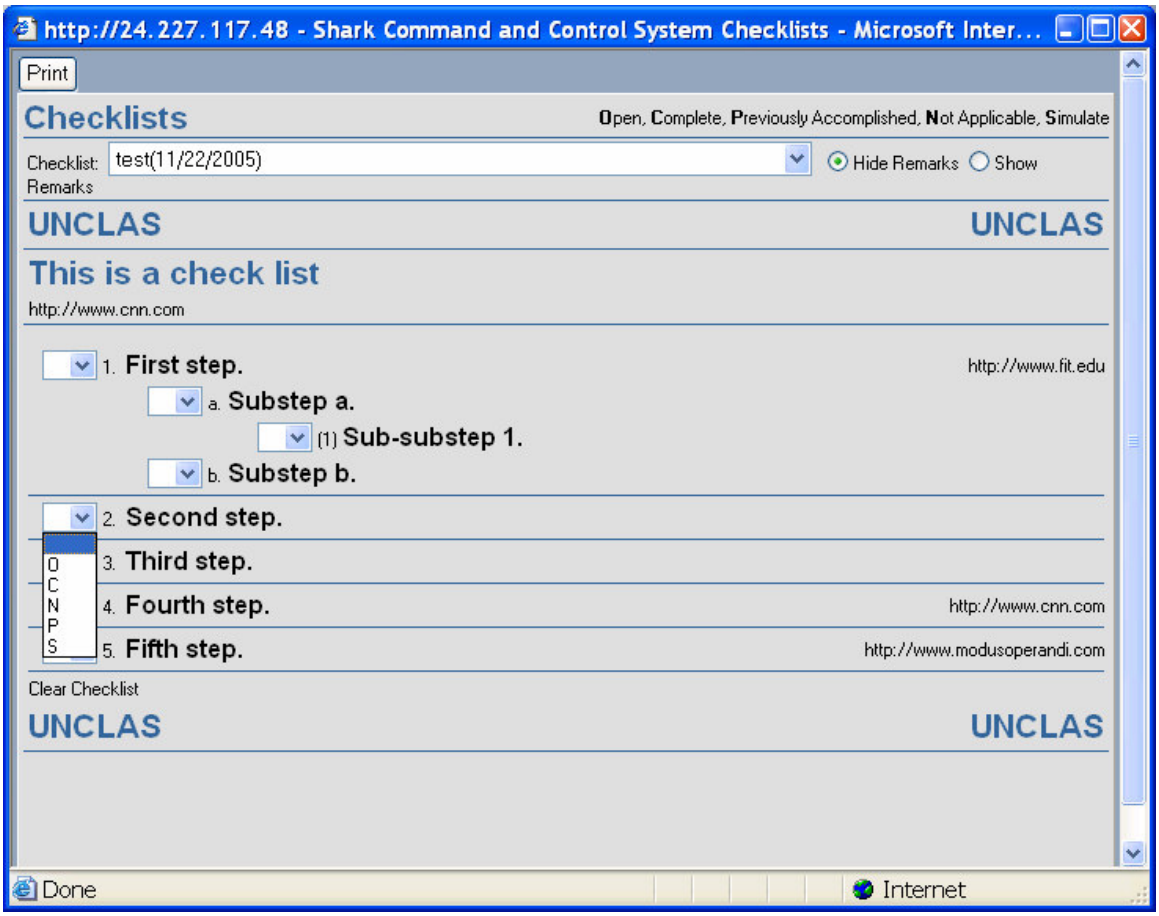

Figure 9: Example Checklist

3.2.2 Branding

The 45th Space Wing wished to have the 45th Space Wing logo displayed. They also wanted to have the name "Shark Command and Control System" appear. The 45th Space Wing logo and the SCCS name were added to WebEOC for display on the dashboard and a variety of boards developed for the 45th Space Wing.

3.2.3 Connection to the KMF / Wave

Modus Operandi found that connecting WebEOC boards to the Knowledge Management Framework to access federated data was straightforward. The high-level architecture is illustrated in Figure 10 below.

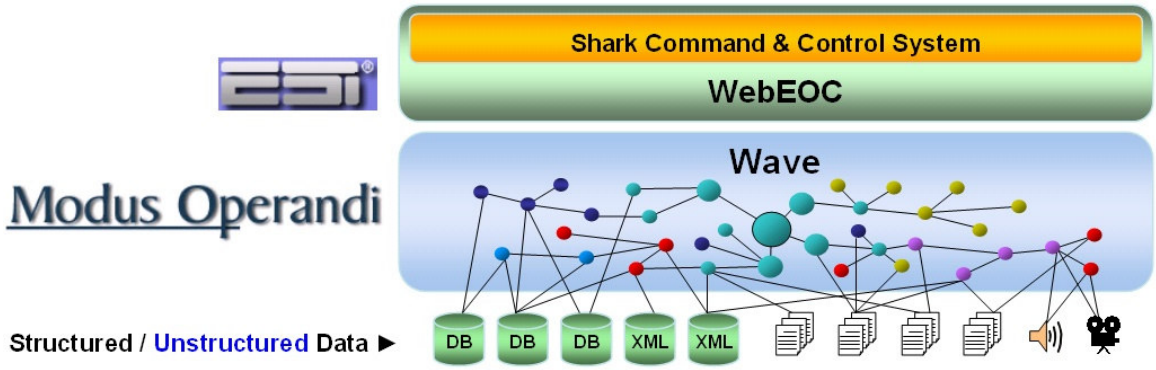

Figure 10: WebEOC connection to the KMF / Wave

One instance of the integration between WebEOC and the KMF / Wave is the SCCS board supporting daily situation reports (SITREP) for the Range Management Squadron. This board required data from a database connected to the KMF. Using the advanced board editor, the following code snippet was inserted into the html for the board at the appropriate place:

```
<tr id="CSRdataFromKMF">
        <td background="">CSR Item<br/></td><td></td>
        <td background="" rowSpan="14" valign="top">
                <input type="text" name="KMFDataKey" value=""
                    class="htckmfcombobox"    QueryName="SITREPQuery"
                    bShowDecorator="true"></input>
        </td>
</tr>
```

The code reflects the use of a combo box developed by Modus Operandi called htckmfcombobox. There is also an XQuery referred to as SITREPQuery and a data key that tells the KMF what data is required. Figure 11 below shows the board when it is first loaded. Note that there are areas on the right where it displays that it is loading KMF data.

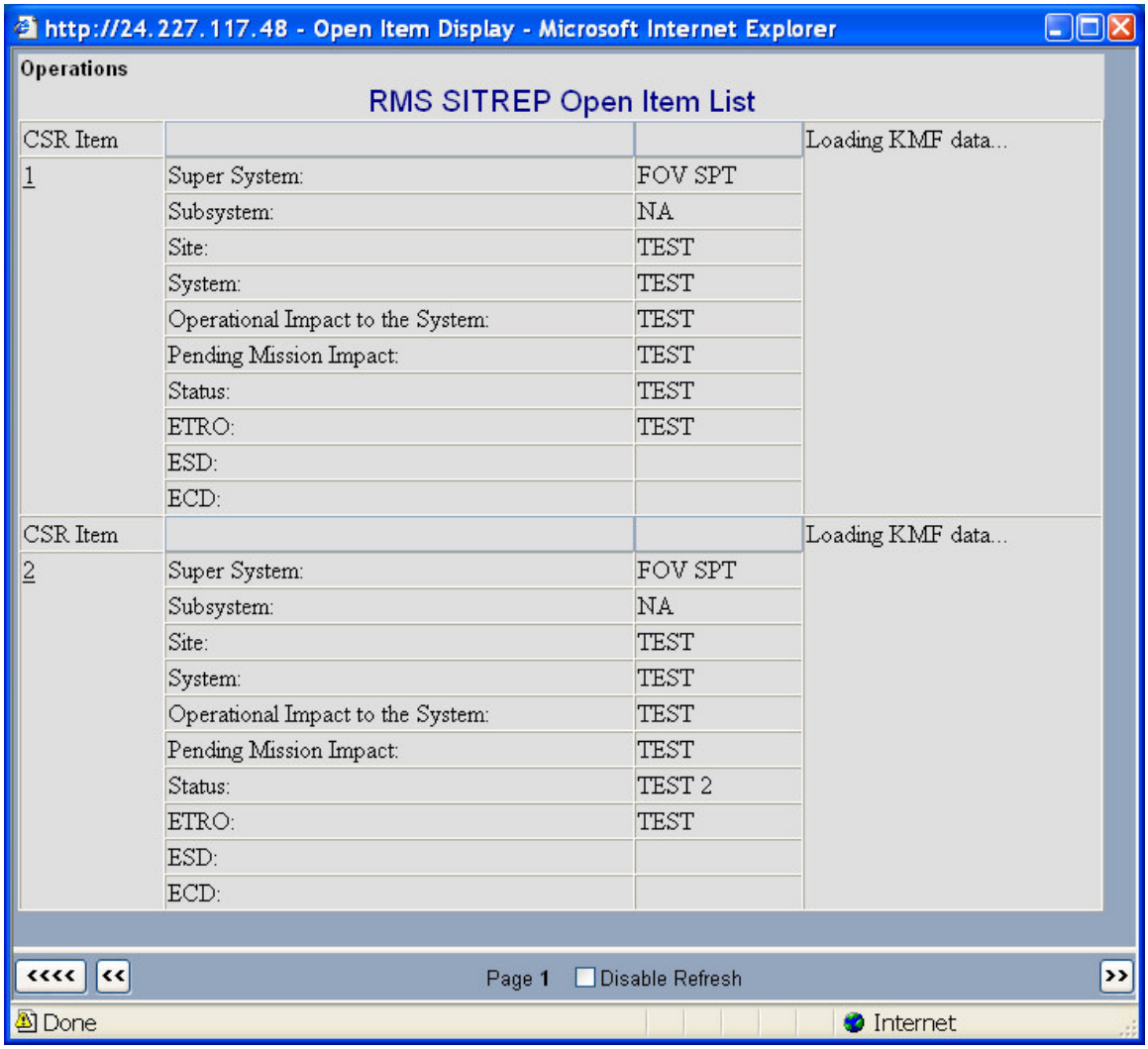

Figure 11: Loading KMF data into a board

In this example the data was retrieved in about one second. Figure 12 below shows the board with a list of items retrieved from the database.

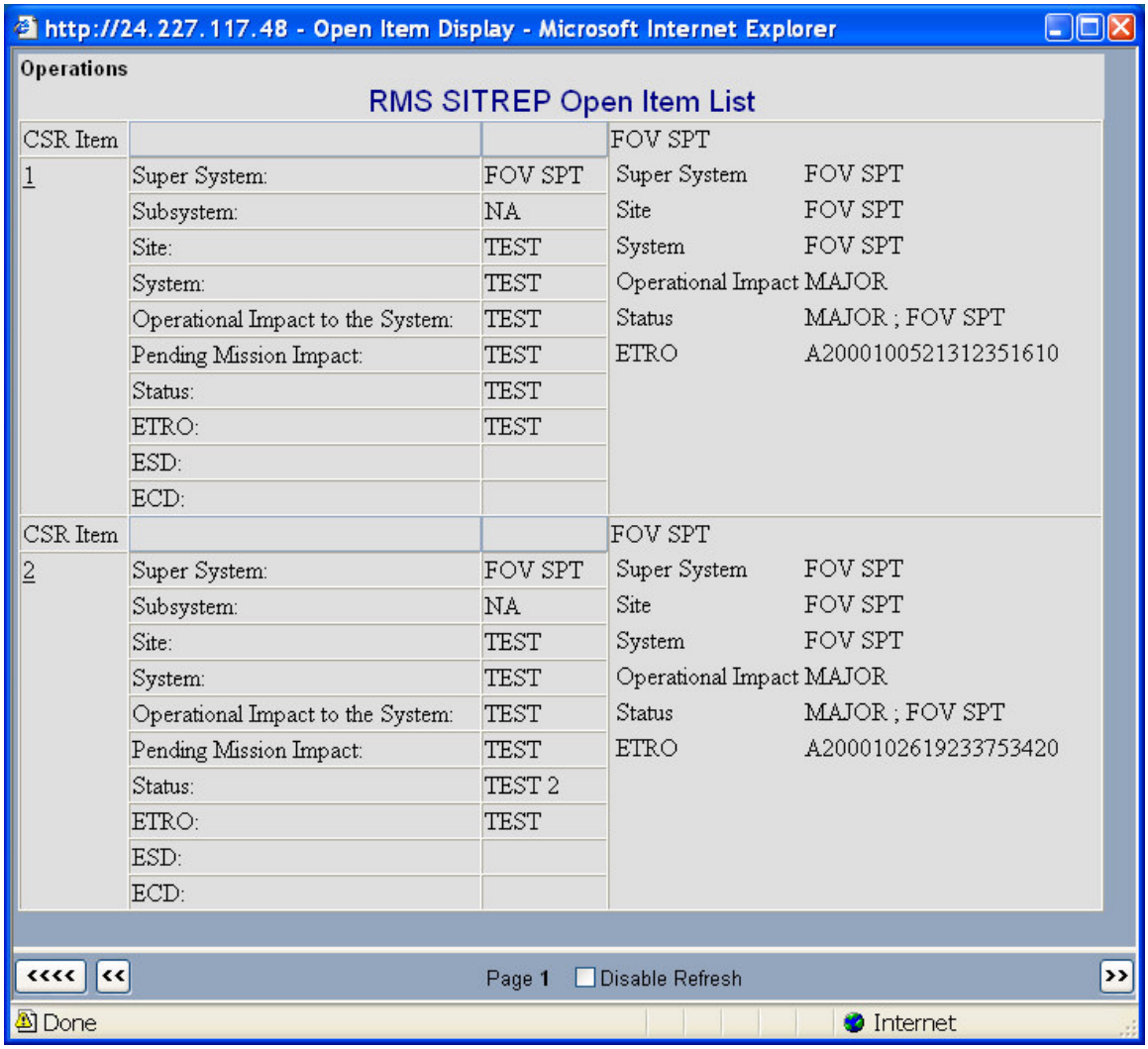

Figure 12: Displaying data from the KMF within a board

3.2.4 Mobile Capabilities

Due to the proximity of PAFB and CCAFS to the ocean, any hurricane that affects the immediate area may prompt an evacuation of the facilities. Depending on the severity of the event, the evacuation may be to a facility on the mainland in nearby Malabar, or as far away as Moody Air Force Base. To allow the 45th Space Wing to continue to operate SCCS, one of the redundant servers is "ruggedized" and easy to carry, thereby giving it a mobile capability. The command post area itself is configured with its own subnet that can continue to operate in a local mode even if the main PAFB LAN is not operational. The server, a set of laptops, and the LAN equipment (dubbed "LAN in a can" by the Communications Squadron) can be moved to an alternate location and set up to provide the 45th Space Wing with the capability to operate SCCS in an isolated mode. At a facility such as Moody Air Force Base, SCCS could be connected into the base network and be operated in a fully connected mode. WebEOC coupled with Double-Take™ insure

that upon return to PAFB/CCAFS, the redundant server will be re-synched to the mobile server and normal operations will be restored.

3.2.5 Airfield Operations

While there were no customizations to WebEOC performed for the purpose of airfield operations, this area provides an excellent example of a situation where the way people do business was changed to be more efficient.

Patrick Air Force Base is a Prior Permission Required (PPR) airfield. Aircraft not stationed at Patrick must request permission from Airfield Operations to land at the base. The process of recording, approving, and updating requests and the process of maintaining the Flight Logs detailing the actual arrivals and departures of aircraft were performed manually. Word, PowerPoint, and Excel documents were the methods for recording information and telephones provided the communications with the command post, tower, the protocol office, and the safety office. The safety office needs to be notified if an inbound aircraft is carrying hazardous cargo and the protocol office must be informed if there is a distinguished visitor aboard.

Using WebEOC's capabilities, Modus Operandi automated Airfield Operations. Boards were built for request logs, flight logs, frequencies, and base conditions and users at the tower and airfield operations were given logins so that all communication could be through board updates, events, chat, and messages. There are plans to bring the protocol office and safety office online with WebEOC so that they can also automate their operations and communicate easily with other organizations. This demonstrates the adaptability of WebEOC and the ease with which it can be used to automate day-to-day activities as well as crisis management operations. Figures 13 – 15 show some of the boards developed for the purpose of Airfield Operations.

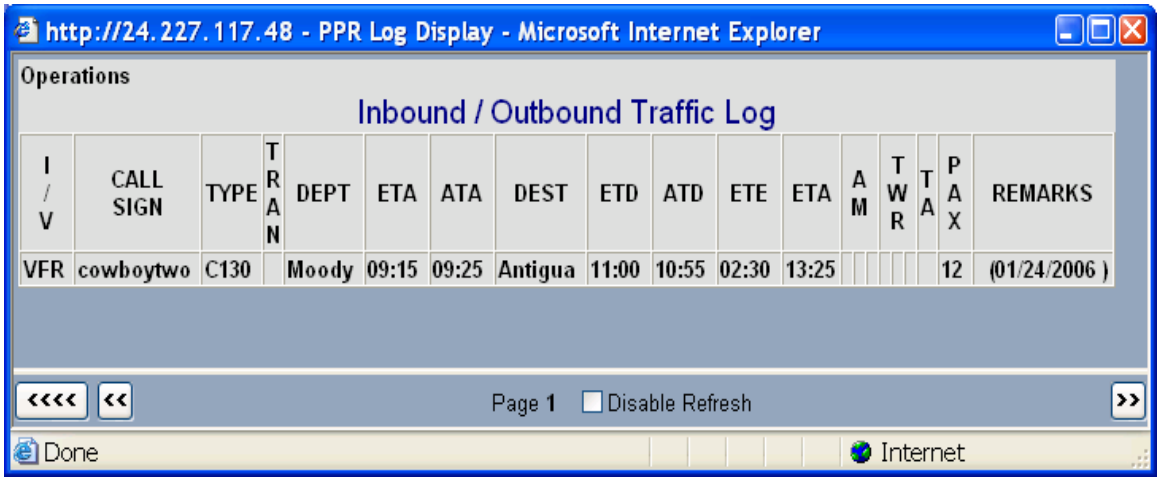

Figure 13: The PPR Log

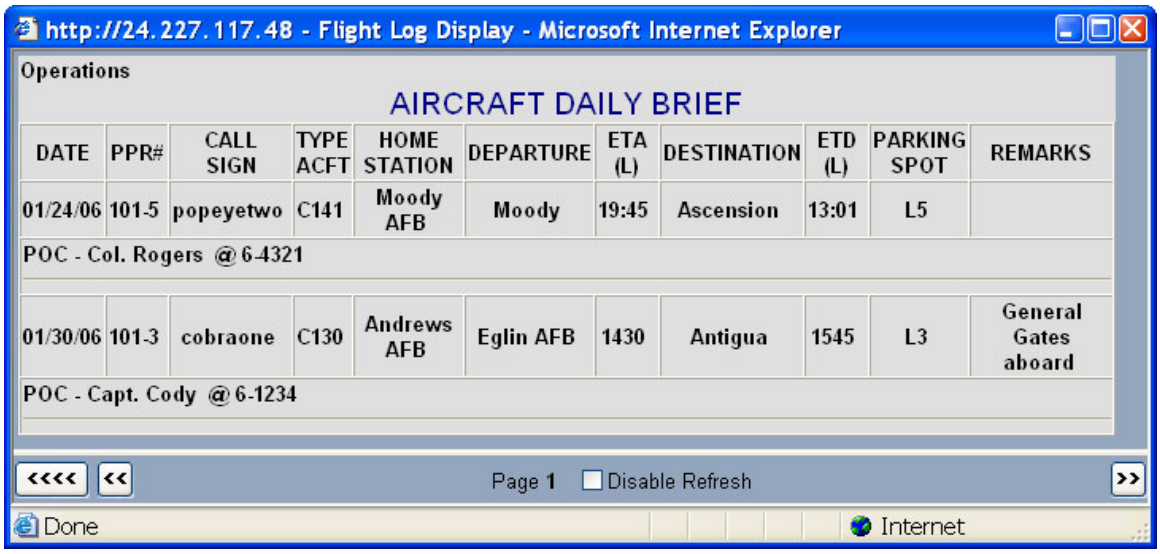

Figure 14: The Flight Log

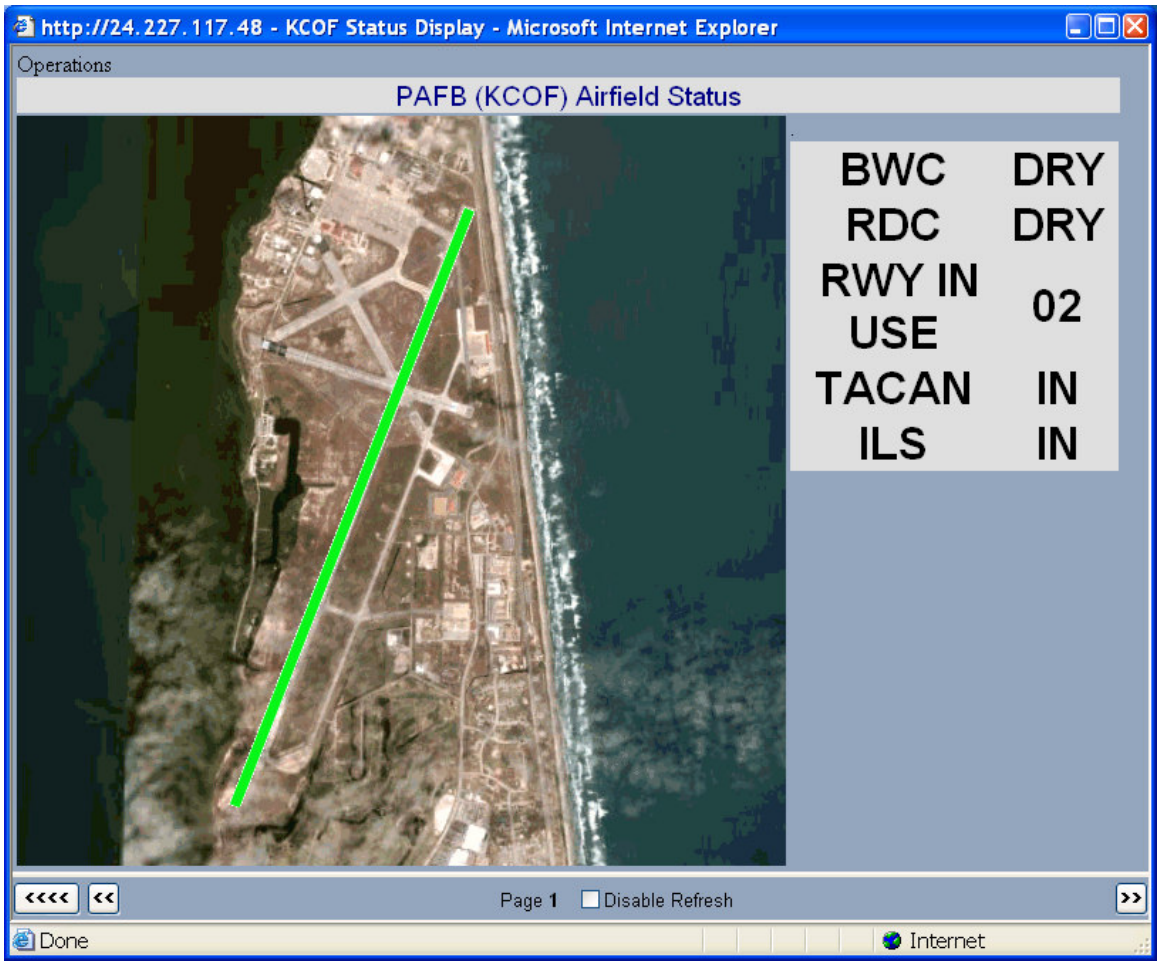

Figure 15: Airfield Status

3.2.6 Hurricane Operations

One of the advantages that the 45th Space Wing has reaped from the use of WebEOC is closer cooperation with the JBOSC EOC. After WebEOC was installed for command post operations, the JBOSC personnel made all of their hurricane related boards available through the export capability. These boards were imported into SCCS and this enabled SCCS to be ready for hurricane operations much sooner than would otherwise be the case. Moreover, WebEOC's Dual Commit capability was employed to automatically post data to the JBOSC EOC from the 45th Space Wing's SCCS. This means that the command picture during hurricane conditions is no longer fragmented because it is no longer dependent on users remembering to report data to two separate installations.

4 Looking Ahead

Wave can be used to connect multiple instances of WebEOC and other EMS data at the city, county, state, and regional levels to provide a previously unavailable degree of real-time emergency operations visibility. Wave's data federation and interoperability features allow data to be shared among different emergency management and command post centers so that a clear picture of an entire region can be provided. Figure 16 below illustrates the connection of multiple WebEOC systems and EMS sources via Wave.

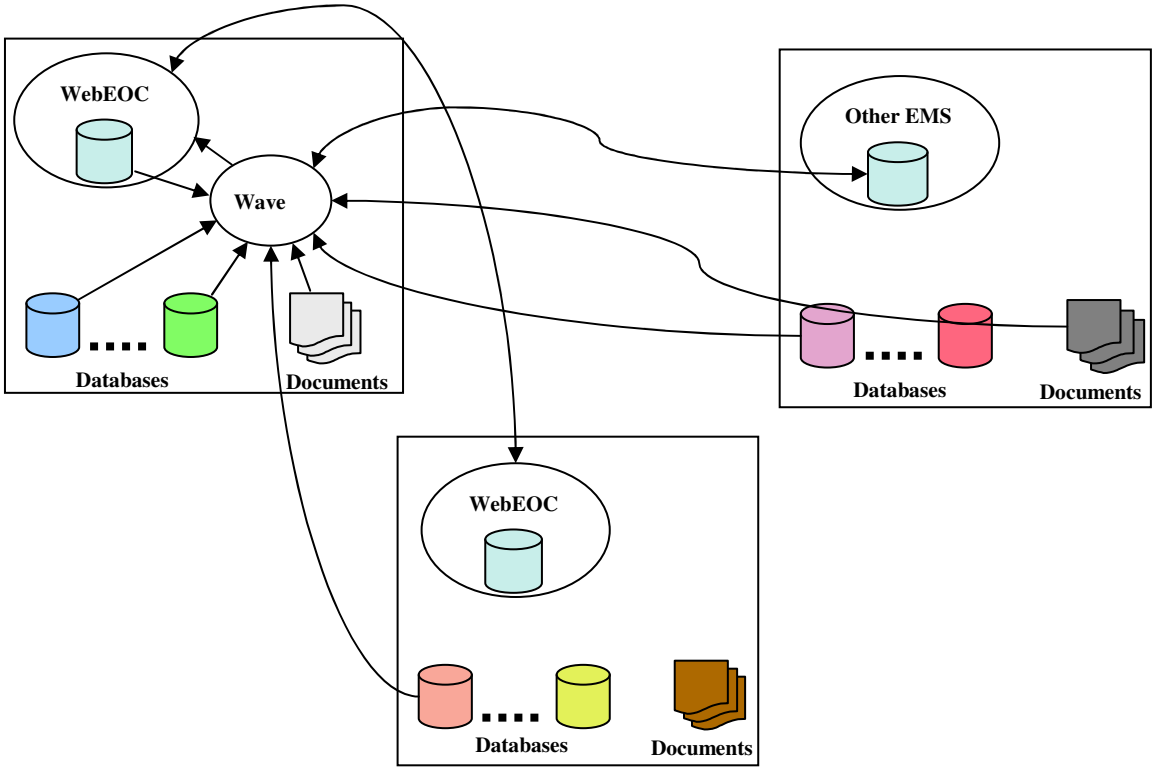

Figure 16: Connecting multiple WebEOC systems and EMS sources via Wave

Emergency management personnel at a state, regional, or large urban area level can also benefit from the combination of WebEOC and Wave. Wave allows data to be federated from among different emergency management and command post centers so that a clear picture of an entire region can be provided. Working with local EOC's, state and regional emergency management personnel can decide what information is important to have available at the state/regional level to form an integrated picture. On the other hand, local EOC's would benefit from the ability to access Wave for information that would show them a picture of conditions in adjacent areas of responsibility. Figure 17 illustrates a scenario in which a state or regional level EOC collects information from a variety of local EOC's to provide an integrated view of the state or region. When EmerGeo™ is added to WebEOC installations at the state or regional level, or even at a local level, emergency management personnel can use data collected via Wave to plot incidents and events within a geo-spatial context that can vastly improve the overall picture of their area of responsibility.

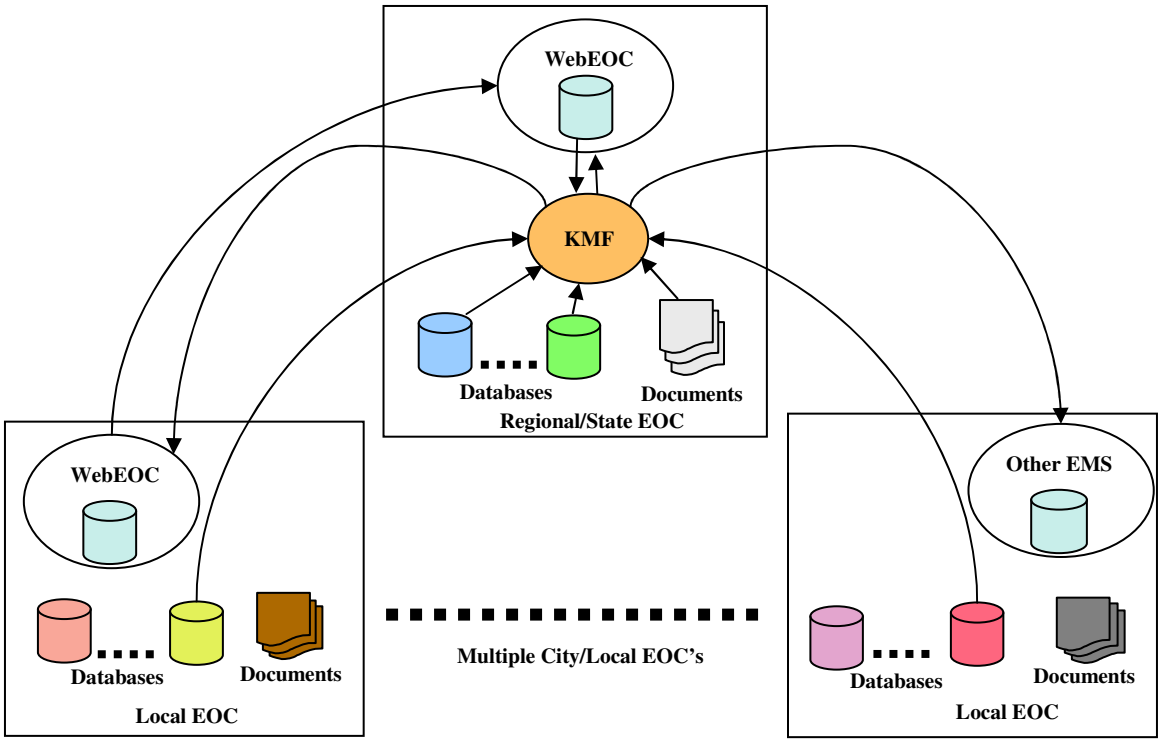

Figure 17: Regional/State Level Integration of Local EOC's

5 Conclusion

WebEOC can be easily adapted to serve as the basis for a daily command post style of operation, as illustrated by the Shark Command and Control System. Using WebEOC on a daily basis maximizes the value of an organization's investment in WebEOC and could allow a state, county, municipality, or region to integrate daily operations with their emergency management activities. By managing daily operations as monthly or weekly

incidents, an organization can provide itself with an excellent archive of simulation data for subsequent training purposes. Continuation of normal daily activities during emergencies is supported, as WebEOC allows emergency incidents and a daily operations incident to co-exist and inter-operate.

When WebEOC is combined with Modus Operandi's Wave product, operational capabilities are significantly increased. The ability to leverage integrated data stored in WebEOC's database, data in CAD 911 databases, fleet management systems, asset management systems, documents, and other data sources allows WebEOC to provide one-stop daily and emergency management.

WebEOC and the Wave product together provide a powerful solution for emergency management and command post operations in an integrated environment.